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ABSTRACT

This study explored how motivational and achievement factors interact and affect persistence in minority undergraduate engineering students. Study participants were 38 entering Mexican and African American college students in an engineering program at a large, southwestern university in the Fall of 1990. Each student was assigned to a peer counseling group designed to solicit information on how students negotiated their way through the engineering program. In the course of the study, which lasted three semesters, students completed questionnaires and were interviewed by telephone. Analysis of the students' perceptions of their experiences showed that successful students more frequently described specific learning strategies they used and offered more details about what they would do and why. In addition, low achievers referred to poor teaching in response to factors which hindered their achievement though close to half of the successful students also mentioned poor teaching. As a group the students generally sounded alienated, discouraged and/or overwhelmed by the program's difficulty, how hard they had to work to keep up, and how difficult it was to obtain good grades. Comments that characterized the system as hostile were as frequent among the successful students as among unsuccessful students. Appendixes contain study instruments. (Contains 33 references.) (JB)

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# FACTORS INFLUENCING THE PERSISTENCE OF ETHNIC MINORITY STUDENTS ENROLLED IN A COLLEGE ENGINEERING PROGRAM

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# Factors Influencing the Persistence of Ethnic Minority Students Enrolled in a College Engineering Program

Cognitive theory has provided researchers with a variety of constructs with which to examine achievement and persistence on academic tasks. Motivational theories such as; attribution theory (Weiner, 1985), attributional style (Peterson & Barrett, 1987), expectancy-value (Eccles, Adler, Futterman, Goff, Kaczala, Meece & Midgley, 1983), and mastery/performance goals (Dweck & Elliot, 1983) have focused on the cognitive-affective influences upon academic achievement. Researchers such as Tinto (1988) and Kraft (1991) have emphasized the effect of institutional commitment, teacher involvement and other social variables on college retention. Other researchers such as Weinstein and Mayer (1986) and McKeachie, Pintrich, Lin and Smith (1986) have examined the effects of learning strategies upon student academic success. In applying these motivational, learning, and social constructs cross-culturally, however, it is assumed, rather than proven, that they continue to have explanatory value.

## *Ethnic Minorities in the United States*

American culture is rapidly changing, undergoing vast ethnographic and demographic changes. The increasing growth of ethnic minority populations in the United States and their relative underrepresentation in American universities and high-level jobs is of serious sociological and psychological consideration. In the 1980's, the number of Hispanics in the United States exploded. Hispanic population increased by 53 percent, to 22.4 million and now comprises about 9 percent of the U.S. population. The number of African Americans grew by only 13 percent over the decade, but, at about 30 million, they remain the largest United States ethnic minority, comprising 12 percent of the total population. The result of these developments is that one of every five American- at least 49.1 million of the nations 248.7 million people- belongs to a non-white racial-ethnic minority.

A study of American demographics and economic trends, "Workforce 2000," concluded that in the remaining years of this century, about 85 percent of the growth in the labor force will be from women, minorities and immigrants. However, African American men and Hispanics are predicted to have the most difficulty finding jobs because of their lack of skills.

## *Ethnic Minorities in Higher Education*

Affirmative action and active minority recruitment in the late sixties and early seventies were responsible for dramatic increases in African American and Hispanic student enrollment in public colleges and

universities. By 1979, African American high school graduates were entering college at about the same rate as their white peers (Mingle, 1980). Despite these gains, Hispanics and African Americans made little progress in achieving parity with whites in college participation during the latter half of the 1980's. In 1989, 28.7 percent of Hispanics and 30.8 percent of African Americans of college age were enrolled in college, in contrast to 38.8 percent of whites (Carter & Wison, 1990).

In addition to the disparity in enrollment rates, the retention of African American and Hispanic students in higher education has emerged as a still more difficult task than simply increasing ethnic minority freshman admissions (Cross & Astin, 1981). African American and Hispanic students in white institutions tend to have higher attrition rates, lower grade point averages and lower enrollments in post-graduate programs than whites in the same institutions (Allen, 1981; Suen, 1983; Lunneborg & Lunneborg, 1985). The situation for Hispanics is even bleaker, especially given that demographers consider them to be the fastest growing ethnic minority group in the United States.

Efforts to reduce disparities between ethnic minorities and whites in retention rates have had limited success. In 1987-1988, African American and Hispanic students were taking longer to complete their academic studies and dropping out of college at higher overall rates than white students (Saldana, 1990). Such statistics are especially disheartening in light of the rapid development of formal and informal support systems, such as retention programs, for ethnic minority students on college campuses.

Retention programs designed for ethnic minority students seek to ease the transition from high school to university life. These programs vary in what they offer students. Among them are financial assistance, mentoring programs, seminars and orientation programs, counseling and mental health services, and the establishment of ethnic minority organizations and cultural service centers. According to a recent report by the Texas A&M Research Foundation (1990), some support programs do appear to exert a large and statistically significant effect on African American and Hispanic academic achievement. Perhaps more interestingly, it was found that those programs which were directed towards the social as opposed to academic integration of ethnic minority students were most likely to have a positive effect on retention. Such findings suggest that not only ability and cognitive factors should be examined with respect to minority achievement, but motivational and social factors as well.

*Statement of the Problem*

If we are to continue to prosper as a nation, and more importantly, if we are to be a society in which occupational and educational opportunities are available to members of all ethnic groups, the factors which affect achievement in *all* types of individuals - not only in those of the current

majority culture - need to be understood. Presently, there is a shocking sparsity of research on cognitive, motivational and social factors which specifically affect minority retention at the college level. Research on ethnic minority achievement and persistence at the college level has focused on comparisons of particular attributions of these groups to white subjects following success or failure at achievement tasks. In addition, cognitive constructs previously used with white students have been examined and differences in results when applied to ethnic minority students noted (Bar-Tal, 1982; Friend & Neale, 1972; Graham & Long, 1984; Maehr & Nicholls, 1980). Hui and Triandis (1989), cross-cultural psychologists, have noted that attributions for causality for success and failure vary from culture to culture as well as from person to person.

Our concern is then, if we are to assess more precisely the factors which affect academic achievement and persistence of minority students, we need additional information on how *they* perceive their academic experience. Particularly, what factors play a part in retention or attrition of minority students over time. We already know that there are differences between cultures. What is of greater interest are the underlying *processes* which mediate these differences, and what is of particular interest to the educator is *how* motivational and achievement factors interact given individual differences in students.

## Methods

### *Subjects*

Subjects were 38 ethnic minority college students who enrolled in a college engineering program at a large, southwestern university in the fall semester of 1990. At the beginning of the semester, all freshmen Hispanic and African American students had been assigned to one of 26 different peer counseling groups. These groups were established as part of the university's Equal Opportunity in Engineering program, which targets it's retention efforts at these two groups. For the purposes of this study, four peer counseling groups, each of which consisted of nine or ten freshmen, were selected. Seven of the subjects were women, thirty-one of them male. This ratio is consistent with the distribution of males and females enrolled in engineering at this institution. Of the thirty-eight subjects, twelve were African American and twenty-six were Hispanic of Mexican-American origin. This ratio represents a slightly larger percentage of African American students than exists in the university engineering program as a whole.

### *Program Description*

Beginning in the spring of 1990, coordinators and counselors working with the Equal Opportunities in Engineering (EOE) program were

interviewed about the programs which they provided to ethnic minority students in the college. The EOE office was established with the goal of achieving a student body in the College of Engineering which represented the ethnic distribution of the college-age population within the state. This office, in an effort to achieve this goal, directs a recruitment program, maintains minority student organizations, garners financial support from industrial contributions, and coordinates a program to minimize attrition during the first two years of college.

The EOE program consists of several sub-programs specifically aimed at minimizing attrition: a freshman orientation program; a faculty mentor program; engineering, math and science tutorials; academic counseling; peer counselling; and two student engineering organizations. Input from the program coordinators was solicited to determine which of these parts of the program would be the most appropriate vehicle by which to investigate the experience of incoming minority freshman engineers. The coordinators of the EOE program emphasized the importance of peer support groups in deterring attrition of students and sought to facilitate the formation of these groups through a peer mentoring program. Their observations were consistent with current studies which suggest that the degree of academic and social integration is predictive of retention (Tinto, 1988; Tracey & Sedlacek, 1987).

The Engineering Peer Support (EPS) program was thus selected as a method by which both students and their peer counselors might be solicited for information on how students negotiated their way through the engineering program. The academic counselor, who coordinates these groups, agreed to provide the investigators with additional information about issues involving students with academic difficulties and students who chose to leave the engineering program.

*Procedure*

In the fall of 1990, the investigators attended orientation meetings, faculty mentor meetings, receptions, a peer counselor training and a peer support orientation for freshmen engineering students. Peer counselors were solicited for participation in the study. During the peer support orientation, a background questionnaire was passed out to all students. The purpose of this study was explained to those attending and volunteers were solicited.

During the third week of the semester, when all of the peer support group assignments had been made, four peer groups were selected with the consent of their respective peer counselors and with the cooperation of the academic counselor. Subjects in the four peer counselling groups, were then contacted and invited to participate in a longitudinal study of student use of minority support programs.

During the first semester, each peer counselor was contacted twice about the number of times the group had met, the number of students

attending the peer group, and the overall adjustment of the students in their study groups. Questionnaires were distributed by the peer counselors mid-semester to question the students in the groups about their use of other services available to them through EOE.

At the end of the semester, all thirty-eight subjects were interviewed by telephone about their use of EOE services and their academic experiences during their first semester. The general question of interest to the investigators was, "What are the factors which influence the retention of ethnic minorities in this college of engineering?" A more specific question was: "What services and strategies do these students use and why?" Using previous studies on college academic achievement (Ames & Archer, 1988; McKeachie et al., 1986; Perry & Penner, 1990) and input from the academic counselor and EOE coordinators, a list of questions was developed (See Appendix A). Students were asked to refer to one of their introductory science or math courses when responding to the questions to provide a more specific context for their responses. While these questions were meant to guide each interview, the subjects were encouraged to, and often did, make additional comments about their experiences and these comments were also recorded.

Additional information was gathered on each student from the background questionnaires that they filled out at the beginning of the semester, and, at the beginning of the Spring 1991 semester, their grades and grade point averages (G.P.A.s) were obtained from the EOE office. In addition, records of their attendance at EPS groups and tutorials were obtained from the peer counselors and tutorial record sheets. This information was added to the information obtained from the telephone interviews.

Responses to questions were examined across each student profile and summarized as a group. Descriptive statistics for the first eight questions were examined and correlated with final grades in the targeted course and overall G.P.A. of each student. Differences between responses obtained from the two ethnic minority groups were noted. Emerging patterns in the data were discussed in frequent meetings with the coordinators of the EOE program and with the academic counselor and between the two investigators.

Based upon the initial analysis of the data, questions pertaining to grade satisfaction, effects of the first semester experience on their approach to the course in the current semester, high school preparation in math and physics, and number of students they knew on campus were added to the interview in the second semester (See Appendix B). Students who had decided to leave the engineering program, or who were contemplating leaving the program were asked for their reasons for doing so. Grades and cumulative G.P.A.s for the second semester were obtained for each student.

Information from both the first and the second semesters was compiled and profiles of each student composed. The students were categorized into one of three groups; "high achievers," "low achievers" and

"departures from the program." "High achieving" students were defined as those students who had remained in the program, had maintained at least an overall G.P.A. of 2.0, and had at least a 2.0 G.P.A. the second semester. The 2.0 G.P.A. cutoff was used since students with grade point averages falling below this level were placed on academic probation by the university, and, after two semesters on academic probation, were subject to dismissal. "Low achievers" were those students who had not maintained this average, but who remained in the program. "Departures" were students who had chosen to leave the program. It was found that, at the end of the first year, all students who had left, or who were planning to leave the program, had done so to pursue new academic goals. None had left because of academic dismissal. However, 14 of the students still remaining in the program had G.P.A.s below a 2.0 at the end of their first year.

Categorization of the sample into the three categories was done independently by the two investigators. These categories were then compared for their reliability. The investigators noted emerging themes from the interview data. These themes from the three categories were then discussed with the coordinators and the academic counselor of the EOE program. Based on suggestions from the EOE personnel and from initial analysis of the first year data, questions from the first year interviews were modified to include the following: the amount of time the student spent studying in groups versus alone, the kinds of academic help they sought, any interaction with faculty, and how well they felt they "fit in" with the engineering program (See Appendix C). At the end of the third semester, all subjects were again interviewed by phone. Again, semester grades for each course and an overall G.P.A. were obtained for each student.

Summary profiles of each student were compiled using the data from the three rounds of interviews. Two variables, GPA and retention status, were then used to create four categories of students: high achievers, low achievers, high achievers departed from engineering, and low achievers departed from engineering. A cumulative G.P.A. and fall semester G.P.A. of 2.0 was used to create the high versus low achiever groups. A few of the "low achievers departed from engineering" began academic suspension in the spring semester of 1992. The university bars the majority of these students from returning to the program until the summer semester of 1992. An examination of these students for their persistence in the engineering program is ongoing and is proposed over the next three years. This paper focuses on the qualitative analysis of the students' comments from the interviews conducted over their first three semesters, and observations and interviews with EOE staff along with quantitative analyses of achievement variables such as GPA and attendance at academic study sessions.

*Analysis*

Using Glasser and Strauss' (1979) constant comparison method, emergent themes were analyzed after the third round of interviews. Themes of particular interest to the investigators, who have a cognitive/motivational orientation, were those associated with academic achievement. These themes were labeled and described independently by the two researchers. These themes and their descriptions were then cross-verified by the investigators together and relabeled and defined. Each investigator then examined the third semester profiles, the first year profiles and the original transcripts for separate verification of the presence of each emerging theme. Original transcripts from the interviews were extracted as supportive evidence for the existence of each theme. The investigators together combined findings from the separate analyses to produce a final description of each theme, along with their properties and dimensions. While a number of themes emerged, for the purpose of this paper only three themes will be the focus. The themes were labelled. The first two were readily identifiable as *learning strategies* and *teaching ability of professor.* The third was somewhat less obvious in name, though unmistakably present. We chose to call it *the hostile system.*

Learning Strategies

Included in the "learning strategies" category were comments about when and how to "read the book"; "working problems" as an important approach to learning the material; type of and effectiveness of "help from others"; and "spending more time studying". For example, when asked "What helped you the most in understanding this course?" and "What would you do differently if you were to start this course over again?" typical student responses were: "Take notes out of the book before attending class", "work more problems", "study ahead of time, at least a week before exams", "try to study every day", and "studying with others got me through the semester".

Teaching Ability of Professor

Responses to the interviews evoked another genre of comments which we labeled "teaching ability of the professor". Included in this second category were students' attributions for success and failure which focus on the professor, the professor's contribution to achievement, and visits to professors during office hours. Two types of remarks were part of this overall category: "good professor" and "bad professor" remarks. "Good professor" responses were descriptions of office visits where the professor was available and helpful, and lectures that included clear examples that supplemented the text and prepared them well for the tests. Most common among the "bad professor" responses were statements such as "the teacher

was not there to teach", "not into teaching" or "not really teaching." Professors getting mad at students, talking down to them, and not explaining well are examples they gave. Words such as "disappointed" and "discouraged" were used to describe their perceptions about the professor. Several students said that they would pick another professor if they had it to do over, and others said they quit going to class or paying attention because they didn't understand or get anything from the lecture.

The Hostile System

The "hostile system" comments referred specifically or by implication to the ubiquitous "they" and had an affective component to them. Most common among comments in this category were references to some courses as "weed outs", departmental multiple choice exams, and "the curve." In reference to the latter, students described not knowing where they stood until the end, not feeling that their grade was a fair representation of what they knew, and not liking that their grades were so low, even in the case of B's. Comments such as "I was caught under the curve." "It's like a government lecture. She just stands up there and talks and we write down stuff and that's it." "Feels like they're trying to get rid of you instead of teach you." These comments occurred most often in response to questions about whether they planned to remain in the program and under what circumstances, if any, the thought of leaving the program crossed their minds. Some comments crossed over with the "teaching ability of the professor" category, but comments in this category were directed at the intent of the professor to "weed them out".

Once identified and described, we looked to see if comments in these categories differentiated successful students, low achievers, and dropouts. We also looked for trends in the themes over time. For instance, were certain themes evident as early as the first semester, or did they emerge over time?

## Results

*Status of Sample*

At the end of the third semester, of the total sample of 38 students, 18 had been categorized as being "successful" (having over a 2.0 GPA the third semester and over a 2.0 cummulative GPA. Of the total categorized "successful" students, half had cummulative GPAs greater than 3.0. Of the 38 students in the "successful" category, 63% were Hispanic and 36% were African American.

A second group was labeled "low achievers" for the purposes of this study. Eight students fell in this category comprising 16% of the Hispanic students and 36% of the African American students in the sample. The

students are presently on academic probation and consequently at risk for dropping out.

Among the 12 students who have left the engineering program, two were "successful" students who changed their majors, while four were low achievers who changed their majors. The remaining six students have left the program or been temporarily suspended because of their poor grades. Twenty-one percent of the Hispanic students and 28% of the African American students in the sample fall in this category.

*Learning Strategies*

One factor that appeared to be consistent across the various comments in this category was that the successful students more frequently described specific learning strategies they used, and they offered more details about what they would do and why. For instance 72% of the successful students said that reading the book helped the most, and a third of the low achievers did. Only one student who dropped out mentioned that reading the book was important.. Successful students mentioned when or how they would read, whereas the low achievers and drop out did not.

A similar phenomenon was seen in comments about "working problems" and "studying more". Half of the successful students said that working problems helped them the most. Low achievers referred to working homework problems but not to working problems in addition to those assigned. The successful students on the other hand, talked about working extra or supplemental problems, not just the homework, and specified where they found these problems: study guides, old tests, worksheets from professors or other help sessions. Only 24% of the drop outs mentioned working problems. When asked what they would do differently, low achievers and drop outs simply said that they would spend more time or more hours studying, while successful students specified when and how they would study differently.

Most of the students mentioned seeking some type of help from others. Study groups and EMS classes (Engineering Math/Science supplemental instruction) were the most frequently mentioned, followed by tutors, student assistants available at "homework tables" in one of the departments, the university learning skills center, TA's and professors' office hours. However, when successful students describe getting help from others they often refer to working in groups with "friends". Half of the successful students reported using a tutor or going to a teaching assistant for help. Half of the successful students (not necessarily the same half) also said that the EMS classes helped them most. This was not the case among the less successful students.

While all but one "low achiever" used either a tutor or went to a TA for assistance, only one of the students who dropped out went to a TA.

None of the dropouts used a tutor. Dropouts were more likely to go to the Learning Skills Center and in general reported fewer strategies for helping themselves learn.

In summary, successful students were differentiated from unsuccessful students in that they were more specific about the study strategies they used and mentioned each strategy more frequently than their less successful classmates.

*Teaching Ability of the Professor*

Comments in this category were divided clearly between those about "good professors" and those about "bad professors". "Good professor" comments were noted in approximately half of each of the three groups of students. One fourth of the total sample of students mentioned office visits in which the professor was available and helpful.

Virtually all of the low achievers referred to poor teaching, usually in response to factors which hindered their achievement. "The professor wasn't capable of breaking down problems to the students level." "I wasn't picking up much from the professor at first so I stopped going to class." However, the low achievers were not alone in their evaluations of teaching performance. Close to half of the successful students also mentioned poor teaching with comments similar to those above.

*The Hostile System*

It was rare to hear enthusiasm in the majority of these interviews. In those few cases where comments were positive, they usually were made in relation to interactions with a helpful professor. Students as a group sounded alienated, discouraged, and/or overwhelmed by how hard the program was, how hard they had to work just to keep up, and how difficult it was to get good grades.

This alienation was articulated most strongly by the students who said that "they are just trying to weed us out". A few mentioned condescending professors and one even said that a whole department was condescending. They felt that professors in these "weed out" courses did not care whether they learned or not. Some did not see a relationship between the lectures and the departmental exams that were given. Some students felt that the method of grading, including multiple choice tests, no partial credit, and "the curve", did not reflect what they knew and gave them little information about where they stood. This system set up an atmosphere which was perceived as competitive and in which some students by definition must be less successful.

Comments about the "Hostile System" were as frequent among the successful students as they were among the unsuccessful students. Half of the successful group said that they think about leaving when they get bad test grades and when they feel overworked. These sentiments were almost

always voiced by male students. African American and Hispanics were equally represented, though it was the Hispanics, primarily who used the term "weed out" to describe their experience.

## Discussion

While the limited size and the homogeneity of this sample restrict the generalizability of this study, the results from this qualitative data raise a number of questions relative to students' learning strategies, motivation, and social interactions as they relate to achievement. These questions have implications for cognitive and motivational theories applied to ethnic minorities and suggest a variety of questions about academic achievement in ethnic minorities to be investigated in future research.

### *Learning Strategies*

One such area for further investigation, relative to learning strategies, is suggested by the fact that successful students were more articulate about their use of study strategies. The question then is, are these students in fact more knowledgeable and more effective in their use of study strategies or are they simply better at demonstrating higher verbal skills? If they are more verbal, is there a relationship between this ability and success in the engineering program? Additionally, research on self-regulation suggests that knowledge of strategies and the awareness of when and where the application of these strategies is appropriate affects students' academic achievement (McKeachie, 1986; Mayer, 1988; Weinstein & Mayer, 1986). It might be the case that the successful students in this program have metacognitive skills that the unsuccessful students do not have. This suggests that unsuccessful students might benefit from training in metacognitive learning strategies.

### *Teaching Ability of the Professor*

Knowledge of learning strategies was not the only factor related to academic achievement according to these students. Similar to results found by Kraft (1991), faculty interactions featured prominently in their explanations for what helped them most to understand the course in question. It is important to note here that students did not necessarily have biases towards seeing all professors as good or bad. The same students reported both good and bad experiences with faculty, or referred to experiences with faculty in one interview and not in another. Some students emphasized the role of others in helping them to understand and/or pass a course, and attributed their success to this assistance. Other students attributed their success to their own efforts, sometimes expressing this fact in reaction to the poor teaching ability of the professor.

Seeing teachers as responsible for success or failure is an external stable attribution, according to Weiner's theory of attributions (1985). However, theories concerning external attributions may not entirely explain these students' behavior. It appears that some students, despite their negative perceptions of the teaching ability of their professors, draw on a variety of learning strategies to compensate. On the other hand, there are those whose behavior in a failure situation approximates the construct of learned helplessness (Dweck, 1975). In these cases, expectancy for success is lowered, and consequently effort is less and effective use of strategies is limited. Research on attributional retraining (Perry & Penner, 1990; Platt, 1988) suggests that attributions for success and failure may be changed and significantly linked to academic achievement. However, research by Graham & Long (1984) questions whether attribution theory can be accurately applied to African-American atudents.

*The Hostile System*

Finally, many students perceived the system as being "hostile". Even students with the highest of GPAs felt they were being "weeded out". This system, then, fosters a competitive environment in which some students, by definition, must be losers. Some of these students clearly see themselves as victims of this system. Motivational goal theory (Dweck & Leggett, 1988) suggest that beliefs about ability as being fixed or changeable are related to effort and persistence on academic tasks. This theory predicts that students who believe that they cannot improve their ability in a certain area will emphasize their performance, or grades in this case, rather than learning. A performance orientation is accompanied by anxiety and ambivalence when faced with a difficult task. Even some of the most successful students showed signs of this maladaptive response to this stressful competitive situation. Mastery or learning goals, on the other hand predict continued effort and persistence, learning strategies that promote deeper processing of material, less anxiety and more focussed attention on the task (Dweck & Leggett, 1988; Meece, Blumenfeld, & Hoyle, 1988). Evidence of learning goals was scarce in this sample.

Some of the students said that they had to "teach themselves." These students can be seen as better equipped to deal with future challenges of the same sort, having developed the self-regulation and learning strategies needed to succeed. However, the questions is "At what price?" Attentional capacity theories suggest that the negative emotions that are generated by perceptions of the hostile system compete for attention that could otherwise be focussed on learning (Kahneman, 1973). Will students elect to persist in a system they perceive as hostile in what may already be a stressful cross-cultural situation? Maybe. Saldana (1990) reported that stress may be a barrier to the retention of minority students. The added stress of maintaining responsibility for learning material on their own might add to dropout statistics. Helpful, effective professors and

supportive peers may help to counteract the effect of those courses that are perceived as sabotaging student's effort to succeed.

## Conclusion

In an effort to extend the literature on factors that affect achievement of minority students, this study has focused on the perceptions of students from an engineering program, with the goal of understanding their academic experiences. Grounded theory was selected as a method in an effort to avoid a common pitfall of much cross-cultural research: that of starting with theories developed from white middle class samples, and identifying discrepancies between the effects from the minority sample and those from the sample upon which the theory was developed. The strength of this grounded theory approach to research is the richness of the data that it produces. Although we have used and continue to use cognitive theory to guide our investigation of these students, we do so with caution. Ogbu (1981) points out the limited value in studying one cultural group, developing an explanatory theory and then applying it to another cultural group. The objective of cross-cultural research is to understand and to explain differences in cultural attitudes and behaviors - not simply to document differences. We already know that there are differences between cultures. What is of interest is the underlying *processes* which mediate these differences. The focus of these investigators was how motivational, social, and cognitive factors interact, in the individual experiences of these students.

It is hoped that these results will have implications for future research in the areas of learning strategies, achievement motivation and social interactions within a cross-cultural context. There is a great need to reexamine the premises upon which the current academic "hostile system" is based. Recent findings from studies on motivation and learning in academic contexts suggest that the present academic system may impede rather than facilitate learning under highly competitive conditions, such as exist in undergraduate engineering programs. This study suggests that in this sample of ethnic minority students, the learning strategies in which the student engages, and students' perceptions of the teaching ability of the professor and the academic environment all interact to affect academic achievement.

# APPENDIX A

## PHONE QUESTIONNAIRE
## FALL 1990

**The following questions relate to an introductory course that you are presently taking such as Physics 303K or Calculus.**

Social security #: _____

Intro course name: _____

1. What grade do you expect to receive in this course? _____

   Why? _____

2. On a scale from 1(not very true of me) to 7(very true of me) rate the following in reference to exams in this course.

| | | not very true of me | | | | | | very true of me |
|---|---|---|---|---|---|---|---|---|
| a. | I studied hard for this exam. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| b. | I am good at taking these exams | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| c. | The exams were very easy. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| d. | I approached studying for these exams in the right way. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| e. | I have bad luck when it comes to these kinds of exams. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |

3. Estimate your present average in this course _____

4. Are you satisfied with this grade? _____

   Why or why not? _____

5. How much time did you spend studying this course per week?

   _____

6. Have you attended Engineering Math/Science tutorials (EMS)? _____
   Why or Why not?

   _____

7. Have you attended group meetings with your peer counselor?_____
Why or why not?

_____

8. Have you participated in a study group for this course?_____
If yes, was it helpful? _____ Why or why not?

_____

9. What helped you the most in understanding this course?

_____

10. What would you do differently if you were to start the semester over again?

_____

11. Has the thought of leaving the engineering program crossed your mind?_____

Why/Why not?_____

2. Do you intend to stay in the engineering program?_____

Why or why not?_____

13. What are you most concerned about at this time?

_____

NOTE ANY OTHER RELEVANT COMMENTS IN THE SPACE BELOW.

**Thank you for your cooperation in answering these questions.**

GOOD LUCK ON YOUR FINALS!

## APPENDIX B

## PHONE QUESTIONNAIRE
## SPRING 1991

The following questions relate to an introductory course that you are presently taking such as Physics 303K or Calculus.

Social security #: _____

Intro course name:_____

1. What grade do you expect to receive in this course? _____

   Why?_____

2. On a scale from 1(not very true of me) to 7(very true of me) rate the following in reference to exams in this course.

| | | not very true of me | | | | | | very true of me |
|---|---|---|---|---|---|---|---|---|
| a. | I studied hard for this exam. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| b. | I am good at taking these exams | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| c. | The exams were very easy. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| d. | I approached studying for these exams in the right way. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| e. | I have bad luck when it comes to these kinds of exams. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |

3. Estimate your present average in this course _____

4. Are you satisfied with this grade? _____

   Why or why not?_____

5. How much time did you spend studying this course per week?

   _____

6. Have you attended Engineering Math/Science tutorials (EMS)?_____
   Why or Why not?

   _____

(over)

7. Have you attended group meetings with your peer counselor?_____
Why or why not?

_____

8. Have you participated in a study group for this course?_____
If yes, was it helpful? _____ Why or why not?

_____

9. What helped you the most in understanding this course?

_____

10. What would you do differently if you were to start the semester over again?

_____

11. Has the thought of leaving the engineering program crossed your mind?_____

Why/Why not?_____

12. Do you intend to stay in the engineering program?_____
Why or why not?_____
If you were to leave what would be your reasons?

13. What are you most concerned about at this time?

_____

14. Were you happy with your previous grade in physics?

15. Why?

16. Has that changed how you study for this course this semester?

17. How?

18. Did you take physics in high school?

What grade did you receive?

19. Did you take calculus in high school?

What grade did you receive in it?

20. How many acquaintances do you know on campus?

## APPENDIX C

## PHONE QUESTIONNAIRE
## FALL 1991

The following questions relate to an introductory course that you are presently taking such as Physics 303K or Calculus.

Social security #:

Intro course name:

1. Estimate your present average in this course

2. Are you satisfied with this grade?
Why or why not?

3. On a scale from 1(not very true of me) to 7(very true of me) rate the following in reference to exams in this course.

| | | not very true of me | | | | very true of me | | |
|---|---|---|---|---|---|---|---|---|
| a. | I studied hard for this exam. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| b. | I am good at taking these exams | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| c. | The exams were very easy. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| d. | I approached studying for these exams in the right way. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| e. | I have bad luck when it comes to these kinds of exams. | 1 | 2 | 3 | 4 | 5 | 6 | 7 |

4a. How much time did you spend studying this course overall per week?

4b. How much time did you spend studying with others in this course per week? (e.g. study groups or another student)

5a. Have you participated in a study group for this course?

5b. How many hours per week?

c. What was your experience with a study group? (strengths and weaknesses)

6. What kinds of academic help did you get this semester for this course?
a. EMS?
b. Visit professor
c. Ask questions in class
d. other

7. What helped you the most in understanding this course?

8. How did your experience last year affect what you did this semester?

9. Is there anything that you plan to do differently next semester?

10. How committed are you to becoming an engineer?

11. Do you feel you "fit in" with the engineering program?

13a. Do you intend to stay in the engineering program? Why or why not?

13b. Does the thought of leaving the program ever cross your mind? When? Why?

14. Have you had any individual contact with a faculty member? Describe a recent interaction. What was the situation? Was this typical? If not, describe a more typical experience. (Names not needed but subject would be helpful)

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